Constrained Vapor Bubble (CVB)

PI: Prof. Peter C. Wayner, Jr., Rensselaer Polytechnic Institute
Co-I: Prof. Joel L. Plawsky, Rensselaer Polytechnic Institute
PS: David F. Chao, NASA GRC
PM: Ronald Sicker, NASA GRC
Engineering Team: ZIN Technologies, Inc.

Glenn Research Center

Objective:

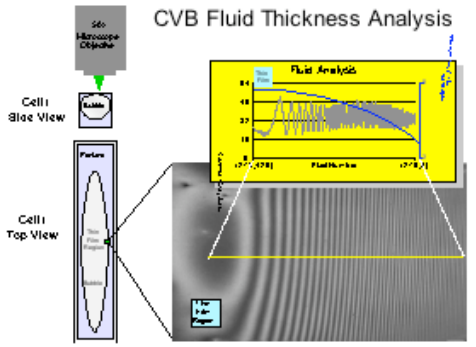
- To determine the overall stability, the fluid flow characteristics, the average heat transfer coefficient in the evaporator, and heat conductance of the constrained vapor bubble, under microgravity conditions, as a function of vapor volume and heat flow rate.

Relevance/Impact:

- CVB is crucial for engineering heat pipes for space applications.
- CVB flow induced by capillary flow eliminating need for wicks.
- Data from CVB will lead to optimally designed heat pipes that will operate at full capacity and provide large weight savings.
- CVB will provide the understanding of the maximum achievable performance of simple heat pipes based on corner flows.

Development Approach:

- The CVB/LMM is designed for autonomous operation through scripts and ground commanding. Crew time is required for initial installation and check out in the Fluids Integrated Rack (FIR), sample change out, and removal from FIR.
- The LMM and CVB flight hardware was developed under a proto-flight approach with the exception of the CVB module which follows the traditional qual/flight approach. The CVB modules will have spares, all other spare hardware will be kitted and assembled as required.
- The LMM and CVB are designed to utilize the FIR capabilities to the maximum extent possible.



ISS Resource Requirements

Accommodation (carrier)	Fluids Integrated Rack (FIR)/LMM
Upmass (kg) (w/o packing factor)	56 Kg for CVB
Volume (m^3) (w/o packing factor)	0.025 CVB
Power (kw) (peak)	0.5kw for CVB/LMM 1.1 kw for FIR/CVB/LMM
Crew Time (hrs) (installation/operations)	34 Hours
Autonomous Operations	2wks/module 5 modules = 10 wks
Launch/Increment	17A/Increment 19

Project Life Cycle Schedule

Milestones	SCR	RDR	PDR	CDR	VRR	Safety	FHA	Launch	Ops	Return	Final Report
Actual/ Baseline	9/97 CVB	12/98 CVB	2/02 LMM/CVB	12/03 LMM/CVB	8/04 LMM/CVB	Phase III 11/05	3/09	8/09	Inc. 19/20	2010	2011
Documentation	Website: eRoom:				SRD: EDMP:			Project Plan: SEMP:			